(12) UK Patent Application (19) GB (11) 2 261 377 (13) A

(43) Date of A publication 19.05.1993

(21) Application No 9123384.1

(22) Date of filing 04.11.1991

(51) INT CL[5]
A61N 1/26, A61H 15/00

(52) UK CL (Edition L)
A5R RER RHXT

(56) Documents cited
DE 003905517 A1 DE 003537081 A1 DE 002636626 A1
DE 002510173 A1

(58) Field of search
UK CL (Edition K) A5R RHXT
INT CL[5] A61H 15/00, A61N 1/26
On-line database: W P I

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(54) Massaging and electro-stimulation device

(57) A massaging device comprises a first electrode comprising at least one rotatable massage element (6), and a second electrode (11). The electrodes are pressed against the tissue to be massaged and current is passed between them whilst the first electrode is rotated to produce combined electric stimulation and biomechanical massage of the tissue. Three balls (6) may be rotatably mounted on a holder (5) which is rotated by a motor (2). The speed of rotation and the current supplied to the electrodes may be varied by means (9) and (10).

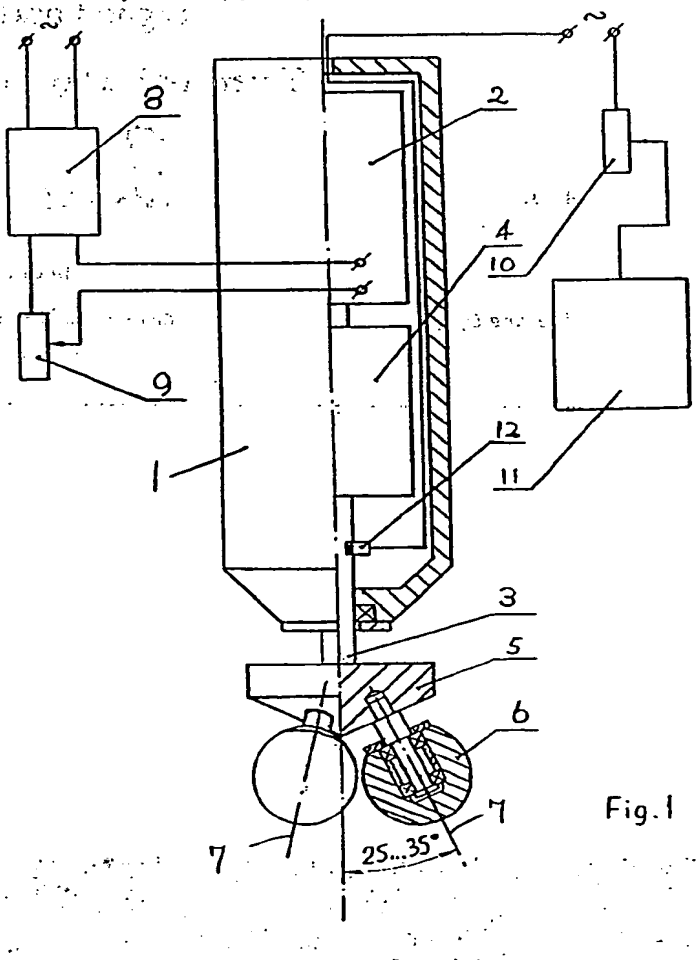

Fig.1

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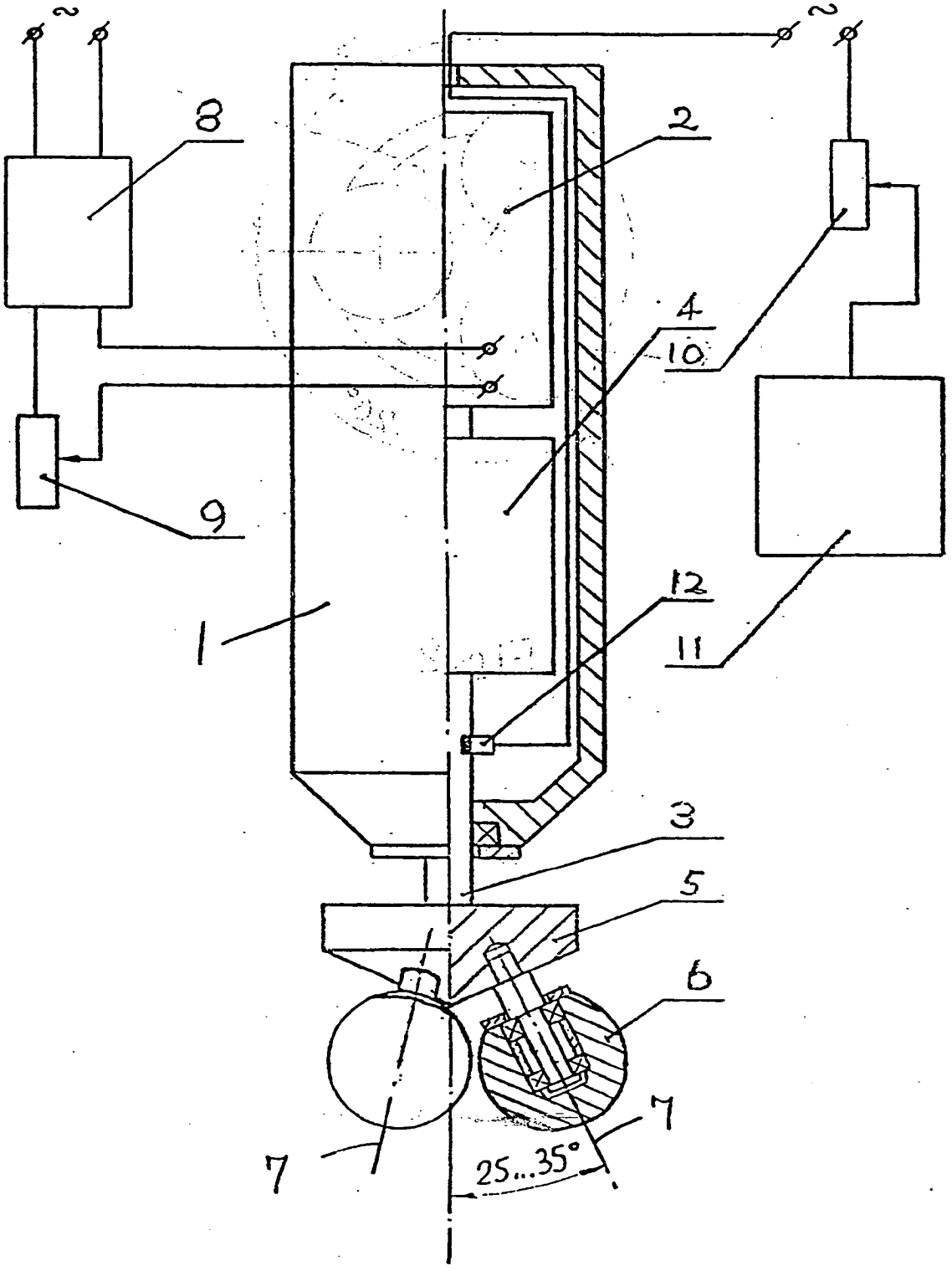

Fig.1

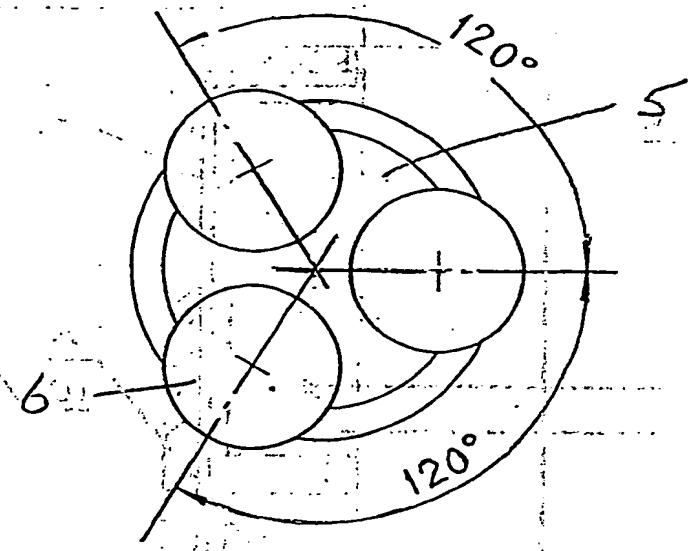

Fig. 2

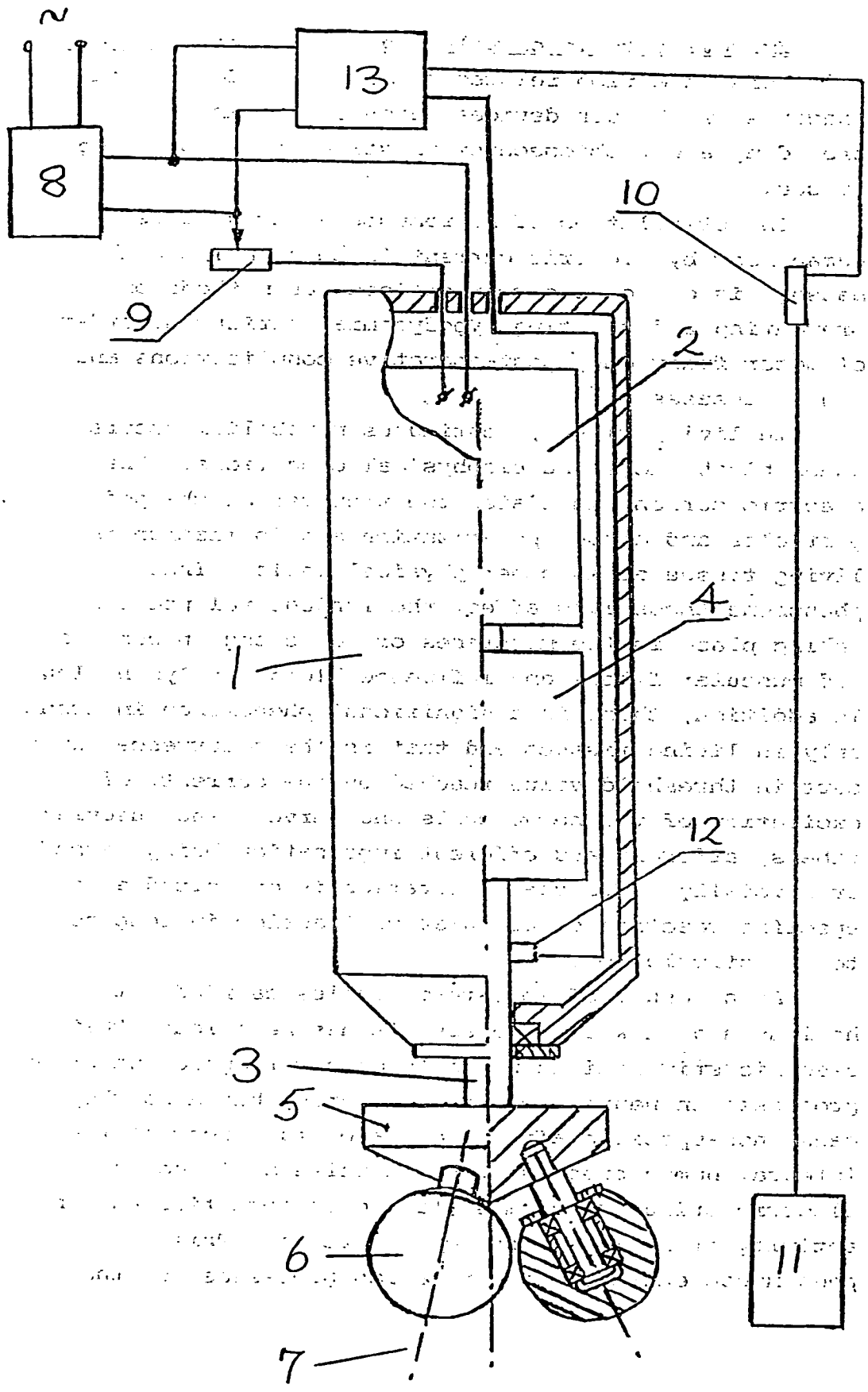

Fig. 3

Improvements in or relating to Massaging Devices

This invention relates to massaging devices and is concerned with such devices which are capable of providing electrobiomechanical stimulation to living tissue.

The stimulation of neuromuscular structures of the human body by electric current in combination with massage is one of the most efficacious methods of preventing and treating hypodynamia, various disorders of motor functions, post-operative complications and other diseases.

In living tissue, continuous metabolism occurs under biochemical and biophysical conditions. The electric current initiates the transfer of charged particles and causes polarization and ionization in living tissue as in other physical media. These phenomena themselves affect the fundamental processes taking place in the membranes of cells and in nervous and muscular fibers and influence blood and lymph flow. In addition, there is a significant phenomenon inherent only in living tissues and that is the occurrence, at a certain threshold value reached by the current, of excitation of the nerve cells and nervous and muscular fibers, afferent and efferent impulsation being caused artificially. Muscular excitation is exhibited as a specific reaction of muscular contraction in response to the stimulation.

As a result of long-term studies carried out on healthy and sick individuals, it has been found that electric stimulations not only effect trophic and other processes in neuromuscular structures, but also they cause non-specific affects on major functions of the integral human organism. By exercise assisted by electric stimulation, muscular power potential and the activity of fermental systems increase. This phenomenon enhances the oxidation processes and the

transformation, in the muscles, of one of the major energetic substrates, namely glycogen, which becomes more open to fermental effects. The glycogen content in muscles increases after electric stimulation for 3-5 days, and the amount of change depends on the duration of each treatment and the number of treatments. An increase in glycolysis following long-term electric stimulation is associated not only with an increase in the glycogen content of the muscles, but also with the rising activity of the glycolytic fermental system as in an ordinary sporting exercise. The muscular mass may increase by 20%.

It is generally known that intensive contractile exercise carried out until the onset of fatigue leads to a reduction of the adenosine triphosphate content and an increase in the amount of adenosine diphosphate and non-organic phosphorus. In non-stimulated muscle, fatigue exercise causes considerable decomposition of adenosine triphosphate and accumulation of non-organic phosphorous, whereas when carrying out a similar exercise with electrical stimulation of the muscle, decomposition of adenosine triphosphate occurs less prominently, i.e. glycolysis and, associated with it, resynthesis of adenosine triphosphate proceeds more intensively.

Electric stimulation prevents accumulations of lactic acid, controls the cholesterol content, and stimulates anaerobic tracts of the metabolism creating thereby optimal conditions for the rational utilization of oxygen by the viscera. Electric stimulation evidently increases the amount of free heparin, the antithrombic activity of arterial blood, the K index and the recalcification time both in the veins and in the arteries i.e. it efficiently prevents complications associated with thrombogenesis in pathologic states.

The therapeutic and training value as well as the

comfort of the sensations during electric stimulation depend, to a consideration extent, on the dimensions and configuration of the stimulating electrodes. The application of constant on-skin electrodes of small dimensions does not make it possible to activate a large number of muscular fibers whereas the use of extensive electrodes placed upon motor points of a denervated or paralysed muscle does not provide the contraction of the whole muscle over the whole range of power values used; only the muscular fascicles directly under the electrodes contract. This appears to be a considerable drawback, since powerful muscular contraction under the effect of electric stimulation is one of the major factors in rehabilitating locomotor system functions in which tendons, ligaments, skeletal muscles are subjected to training exercise.

It is an object of the present invention to provide a massaging device which will overcome the above disadvantage.

According to the present invention there is provided a tissue massaging device comprising a first electrode in the form of at least one rotatable massage element for contacting the tissue and formed of electrically conductive material and a second electrode for placing in contact with the tissue, the device including means for rotating the or each element and means for supplying electric current to the electrodes so that the tissue is subjected to simultaneous biomechanical massage and electric stimulation.

In use, the massaging device is pressed against, and moved over, the tissue of the body so that the body is subjected to neuromuscular electric stimulation by physiological impulses and biomechanical massage of the rotating massage element(s), in combination.

In a particularly preferred embodiment, the or each rotatable massage element is spherical in shape.

Preferably three massage elements are present and are mounted on a rotatable spindle at 120° to each other and in a plane perpendicular to the rotational axis of the spindle. Each massage element is preferably freely rotatable about an axis which is at an angle of from 25 to 35° to the axis of the spindle.

Massage elements of non-spherical shape, such as cylinders and ellipsoids may be used provided that their axes of rotation are such that, in use of the device, they roll over the tissue without causing pain or traumatisation of the skin.

Advantageously, the means for rotating the element(s) is an electric motor in which case a means is preferably provided to control the electric current fed to the motor so that the speed of rotation of the massage element(s) can be varied from, for example, zero to 130 revolutions per minute whereby the intensity of the biomechanical massage can be varied. Also, the device advantageously includes a means of controlling the electric current supplied to the electrodes so that the current passing through the tissue can be varied from, for example, zero to 100 mAmps. In this way, the patient being treated can voluntarily regulate the device in accordance with the biological peculiarities of his body and the degree of comfort required.

In an embodiment, the first electrode is detachably secured to the device and a plurality of first electrodes having rotatable elements of different sizes or different inter-element spacing or having different numbers of rotatable elements is provided. In this way it is possible to obtain optimum stimulation of various body areas.

For a better understanding of the invention and to show how the same may be carried into effect, reference will now be made, by way of example, to the

accompanying drawings, in which:-

Figure 1 is a diagrammatic part-sectioned side view of a first embodiment of a massaging device of the present invention,

Figure 2 is an end view of the device of Figure 1, and

Figure 3 is a view, corresponding to Figure 1, of a second embodiment of the massaging device.

Referring now to Figures 1 and 2 of the drawings, the device comprises a housing 1 containing a DC motor 2 having an output shaft driving a spindle 3 via a reduction gear 4. Mounted on the spindle 3 is a first electrode comprising a holder 5 for three massage elements 6 in the form of balls. Each ball is freely rotatable about its axis 7 and the three balls are fixed at an angle of 120° to each other in a plane perpendicular to the axis of rotation of the spindle 3. The balls are made of electrically conducting material and their axes of rotation 7 are inclined at an angle of 25° to 35° to the axis of rotation of the spindle 3. By positioning the balls in this way, it is possible to stimulate uniformly the whole body area under massage while the free motion of the balls avoids seizing and injury to the skin.

The device is connected to domestic AC mains (e.g. 220V and 50/60 Hz) and includes two electric circuits. One of the circuits includes rectifier 8 and current regulator 9 and feeds current to the DC motor 2 which rotates the spindle 3, and hence the holder 5, at a reduced number of revolutions by virtue of the reduction gear 4. The other electric circuit has one of its phases connected to the conductive balls 6 via a collector 12. The other phase is connected through a current regulator (10) to a flexible second electrode 11 of relatively large area and formed of electrically conductive material. This is to be placed on the skin

adjacent to the area to be massaged by the balls 6 but spaced from the balls 6. (Alternatively, the current regulator 10 may be provided in the phase connected to the balls 6.) The current strength regulator 10 allows the electric impulses to be adjusted over a range of from 0 to 100 mAmps so that the amplitude of the pulses can be varied. Also, the speed of rotation of spindle 3 can be adjusted by current regulator 9. Hence the massaged area of the body is subjected to mechanical and electric stimulation and the patient himself is able to adjust the amperage and the spindle rotation frequency according to his or her requirements and thereby provide complete comfort.

Referring now to Figure 3, parts corresponding to parts of Figures 1 and 2 are denoted by like reference numerals.

In this case, a first circuit includes rectifier 8 and current regulator 9 and supplies the DC motor 2. This rotates the holder 5 via reduction gear 4 and spindle 5. The rectifier 8 is also the current source for a generator 13 of physiological impulses. Thus it includes a second circuit including the generator 13, the collector 12 and the balls 6 whereby physiological impulses are transmitted to the balls 6 which massage the muscle on which they are placed as a consequence of rotation of the holder 5. The flexible second electrode 11 is placed at the other end of the muscle and is connected to the regulator 10 and generator 13 to complete the circuit.

Stimulation through the skin of subcutaneous tissues by means of the device enables human neuromuscular structures to be switched to the active state and provides an analgesic effect. In motor disorders it prevents the development of atrophies, accelerates rehabilitation processes of various functions, increases muscular tension and normalizes

trophicity. Also it increases muscular animal force, endurance and mass and extends motility volume in the joints.

Neuromuscular electric stimulation carried out simultaneously with massage by means of the device of the invention is an efficacious way of normalizing peripheral blood circulation which improves skin turgor and subcutaneous fat and strengthens the muscular walls of blood vessels. An advantageous favourable feature of stimulation by means of the device of the invention is irritation of extensive receptor areas of the skin which provide additional flow of efferent impulsation from peripheral regions. This is extremely significant in pathologic states and may be widely used as a treatment procedure.

As distinct from traditional methods of electric stimulation, the present invention makes it possible to set various values of power, duration and volume of contraction to achieve maximum effect. Also, and simultaneously, mechanical massage, of any duration, of not only a group of muscles, but of all neuromuscular-cutaneous structures of the patient is possible.

Indications for therapeutic use of the present device are the following: limited volume of active movements in joints, undue muscular fatiguability (except for myasthenia), lowered muscular tension, and atrophias of muscular groups. The device may be used for the treatment of residual signs of cerebral circulation (haemiplegiae and haemipareses following haemorrhages and thromboses), injuries of the central nervous system, infantile cerebral paralyses, and lesions of the peripheral part of the nervous system complicated by motor function disorders (patients with flaccid paralyses, spastic paralyses, spastic pareses complicated by joints' contractures). The present device proves itself rather efficacious in the

prevention of post-operative thromboembolic complications during acute periods of myocardial infarction.

Mechanical massage simultaneous with neuromuscular electric stimulation decreases the area of cutaneo-subcutaneous fat and the total amount of depositioned fat. Therapeutic indications of the present device may be commonly prescribed in orthopaedic pathologies, especially during the rehabilitation period of patients following operative treatments of the osteomuscular system and also in complex therapy of osteochondrosis.

There are no absolute contra-indications for the use of electric stimulation assisted by mechanical massage. There may be relative contra-indications in the following diseases: hereditary-familial progressive systemic diseases of the nervous system (progressive muscular dystrophy, neural form of progressive muscular atrophy, myotonia, myasthenia, atony, hepatolenticular degeneration, torsion dystonia, double athetosis, chorea), epilepsy, syringomyelia, multiple sclerosis (in the phase of exacerbation), syphilitic tabes, Sydenham's chorea, other infectious diseases in acute phases of cerebral circulation disorder (acute period), malignant tumors of organs and tissues, cerebral and spinal abscesses, brain diseases induced by parasites (Cysticercus, toxoplasmosis, Echinococcus), critical forms of hypertensive disease, acute and subacute thrombophlebitis, and cutaneous diseases in the acute phase complicated with other diseases (endocrine etc).

Claims:

1. A tissue massaging device comprising a first electrode in the form of at least one rotatable massage element for contacting the tissue and formed of electrically conductive material and a second electrode for placing in contact with the tissue, the device including means for rotating the or each element and means for supplying electric current to the electrodes so that the tissue is subjected to simultaneous biomechanical massage and electric stimulation.

2. A device as claimed in claim 1 wherein the or each massage element is spherical.

3. A device as claimed in claim 1 or 2 wherein three of said massage elements are mounted in a rotatable holder at an angle of 120° to each other.

4. A device as claimed in claim 3 wherein each of said massage elements is rotatable about an axis which is at an angle of from 25 to 35° with respect of the axis of rotation of the holder.

5. A device as claimed in any preceding claim and including a control means to vary the current.

6. A device as claimed in claim 5 wherein the control means is adapted to vary the current from 0 to 100 mAmps.

7. A device as claimed in any preceding claim and including a control means to vary the speed of rotation of the or each massage element.

8. A device as claimed in claim 7 wherein the control means is adapted to vary the speed from 0 to 130 revolutions per minute.

9. A device as claimed in any preceding claim wherein the first electrode is detachably connected.

10. A device as claimed in claim 1 substantially as hereinbefore described with reference to, and as illustrated in, the accompanying drawings.

Patents Act 1977
Examiner's report to the Comptroller under Section 17 (The Search Report)

Application number: 9123384.1

Relevant Technical fields

(i) UK Cl (Edition K) A5R (RHXT)

(ii) Int Cl (Edition 5) A61H 15/00; A61N 1/26

Search Examiner: R S CLARK

Databases (see over)

(i) UK Patent Office

(ii) ONLINE DATABASE: WPI

Date of Search: 19 FEBRUARY 1992

Documents considered relevant following a search in respect of claims 1 TO 10

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
Y	DE 3905517 A1 H C RURUP Column 3	2
X	DE 3537081 A1 R BUSCHDY Figures 5 to 9	1, 7, 8
Y	DE 3537081 A1 R BUSCHKY Figures 5 to 9	2
X	DE 2636626 A1 H WEIERS ET AL Whole document	1, 5, 9
X	DE 2510173 A1 E KLOCNER Figure 7	1, 5, 6

Category	Identity of document and relevant passages	Relevant to claim(s.

Categories of documents

X: Document indicating lack of novelty or of inventive step.

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P: Document published on or after the declared priority date but before the filing date of the present application.

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